

ADDITIONAL FEES:

No additional fees are believed required; however, should it be determined that a fee is due, authorization is hereby given to charge any such fee to our Deposit Account No. 01-0268.

REMARKS

In the last Office Action, the Examiner rejected claims 1, 29-33, 37, 38 and 45 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,089,708 to Asselbergs. Claims 34-36, 39-44 and 46-47 were objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Additional art was cited of interest.

Applicants and applicants' counsel note with appreciation the indication of allowable subject matter concerning claims 34-36, 39-44 and 46-47. However, for the reasons noted below, applicants respectfully submit that newly added claims 48-57 also patentably distinguish from the prior art of record.

In accordance with the present response, page 26, line 5 of the specification has been suitably revised to correct the spelling of "expand". A new abstract which more

clearly reflects the invention to which the amended claims are directed has been substituted for the previously submitted abstract. Allowable claims 34, 39 and 47 have been rewritten in independent form to incorporate the subject matter of corresponding base claims 1, 37 and 45 and intervening claim 46. Claims 1, 29-33, 37, 38, 45 and 46 have been canceled without prejudice of admission, thereby rendering the prior art rejection of these claims moot. New claims 48-57 have been added to provide a fuller scope of coverage. Claims 34-36, 39-44 and 47-57 are currently pending in this application.

Attached hereto is a marked-up version of the changes made to the specification, abstract and claims by the current amendment. The attached pages i-iv are captioned **"VERSION WITH MARKINGS TO SHOW CHANGES MADE"**.

Applicants respectfully request reconsideration of their application in light of the following discussion.

The present invention is directed to a piezoelectric actuator.

As described on pages 1-4 of the specification, conventional piezoelectric actuators, such as shown in Figs. 13A-13C, have a low energy converting efficiency and are unable to output a large vibration output.

The present invention overcomes the drawbacks of the conventional art. Fig. 2 shows an embodiment of a piezoelectric actuator 2 according to the present invention embodied in the claims. The piezoelectric actuator 2 has a plurality of piezoelectric elements 21a-21f, 22a-22l, 23a-23f and 24a-24l stacked in a thickness direction thereof for undergoing expansion/contraction movement to vibrationally drive the piezoelectric actuator 2 in accordance with a driving signal applied to the piezoelectric elements. Each of the piezoelectric elements 21a-21f, 22a-22l, 23a-23f and 24a-24l has a length extending in a direction generally perpendicular to the stacking direction. The length of each of at least two of the piezoelectric elements (e.g., the length of each of the piezoelectric elements 22a-22b) is different from the length of at least one other of the piezoelectric elements (e.g., the length of piezoelectric element 21a).

Preferably, each of the piezoelectric elements 21a-21f, 22a-22l, 23a-23f and 24a-24l has the same thickness in the stacking direction. The length of each of the least two of the piezoelectric elements is preferably shorter than the length of the at least one other of the piezoelectric elements so that each of the at least two of the piezoelectric elements undergo greater expansion/contraction movement than

the at least one other of the piezoelectric elements in accordance with a driving signal applied to the piezoelectric elements 21a-21f, 22a-22l, 23a-23f and 24a-24l. The piezoelectric actuator 2 is driven in a direction generally perpendicular to the stacking direction in accordance with a driving signal applied to the piezoelectric elements 21a-21f, 22a-22l, 23a-23f and 24a-24l.

By the foregoing construction, a piezoelectric actuator which is compact, which has a high energy converting efficiency, which can output a large vibration output and which is simple to manufacture is obtained.

Applicants respectfully submit that the prior art of record does not disclose or suggest the subject matter recited in newly added claims 48-57.

Newly added independent claim 48 is directed to a piezoelectric actuator and requires a plurality of piezoelectric elements stacked in a thickness direction thereof for undergoing expansion/contraction movement to vibrationally drive the piezoelectric actuator in accordance with a driving signal applied to the piezoelectric elements, each of the piezoelectric elements having a length extending in a direction generally perpendicular to the stacking direction, and the length of each of at least two of the piezoelectric elements being different from the length of at least one other of the piezoelectric elements.

The prior art of record does not disclose or suggest the piezoelectric actuator recited in new independent claim 48. For example, Figs. 8a-8h of Asselbergs disclose two piezoelectric elements A, B stacked in a thickness direction thereof and having different lengths in a direction generally perpendicular to the stacking direction. In contrast, independent claim 48 requires that the length of each of at least two of the piezoelectric elements is different from the length of at least one other of the piezoelectric elements. Stated otherwise, Asselbergs discloses only two stacked piezoelectric elements A and B, one having a different (i.e., A is shorter than B) length than the other, while independent claim 48 requires at least two piezoelectric elements each having a length different from the length of at least one other of the piezoelectric elements.

Claims 48-51 depend on and contain all of the limitations of independent claim 48 and, therefore, distinguish from the references at least in the same manner as claim 48.

Moreover, there is a separate ground for patentability of dependent claim 50 which includes the additional limitation that the length of each of the at least two of the piezoelectric elements is shorter than the length of the at least one other of the piezoelectric elements so

that each of the at least two of the piezoelectric elements undergoes greater expansion/contraction movement than the at least one other of the piezoelectric elements in accordance with a driving signal applied to the piezoelectric elements. No corresponding structural combination is disclosed or suggested by the prior art of record.

New independent claim 52 is directed to a piezoelectric actuator and requires a plurality of groups of piezoelectric elements stacked in thickness direction of the piezoelectric elements for undergoing expansion/contraction movement to vibrationally drive the piezoelectric actuator in accordance with a driving signal applied to the piezoelectric elements of each of the groups of piezoelectric elements, each piezoelectric element of each of the groups of piezoelectric elements having a length extending in a longitudinal direction generally perpendicular to the stacking direction, and the length of the piezoelectric elements of at least one of the groups of the piezoelectric elements being different from the length of the piezoelectric elements of at least one other of the groups of the piezoelectric elements. Again, no corresponding structural combination is disclosed or suggested by the prior art of record. For example, Figs. 8a-8d of Asselbergs clearly do not disclose or suggest a plurality of groups of piezoelectric elements stacked in thickness

direction of the piezoelectric elements, as required by independent claim 52.

Claims 53-57 depend on and contain all of the limitations of independent claim 52 and, therefore, distinguish from the references at least in the same manner as claim 52.

Moreover, there are separate ground for patentability of dependent claims 54, 56 and 57.

Claim 54 includes the additional limitation that the length of each of the piezoelectric elements of the least one of the groups of piezoelectric elements is shorter than the length of the piezoelectric elements of the at least one other of the groups of piezoelectric elements so that the piezoelectric elements of the least one of the groups of piezoelectric elements undergo greater expansion/contraction movement than the at least one other of the groups of piezoelectric elements in accordance with a driving signal applied to the piezoelectric elements of each of the groups of piezoelectric elements. No corresponding structure is disclosed or suggested by the prior art of record.

Claim 56 includes the additional limitation that the plurality of groups of piezoelectric elements comprises a first pair of groups of identical piezoelectric elements and a second pair of groups of identical piezoelectric elements

disposed between the first pair of groups of identical piezoelectric elements. Claim 57 includes the additional limitation that the length of each of the piezoelectric elements of the second pair of groups of identical piezoelectric elements is greater than the length of each of the piezoelectric elements of the first pair of groups of identical piezoelectric elements so that the piezoelectric elements of the first pair of groups of identical piezoelectric elements undergo greater expansion/contraction movement than the piezoelectric elements of the second pair of groups of identical piezoelectric elements. Again, no corresponding structure is disclosed or suggested by the prior art of record. For example, Figs. 8a-8d of Asselbergs clearly do not disclose or suggest a first pair of groups of identical piezoelectric elements and a second pair of groups of identical piezoelectric elements disposed between the first pair of groups of identical piezoelectric elements, as required by claims 56 and 57.

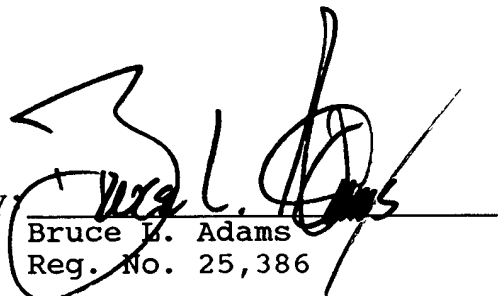
In view of the foregoing amendments and discussion, applicants respectfully submit that the application is now in condition for allowance. Accordingly, favorable

reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

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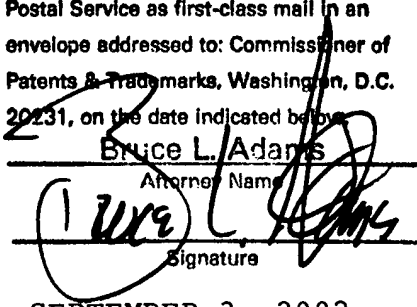
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